the magnetization direction of the pinned magnetic layer of the spin valve film.

For conventional spin valve films having a single-layered, pinned magnetic layer, the direction of the magnetic coupling bias field for pinning the magnetic layer is disordered if the temperature for the thermal treatment for magnetic coupling bias application to the antiferromagnetic film 152 is not lowered to a significant degree. In this respect, conventional spin valve films are poorly practicable. However, based on the properties of the Synthetic AF structure of which the thermal stability for pinning magnetization is greatly stabilized at temperatures not higher than the blocking temperature of the pinned magnetic layer in the structure, the magnetization direction of the longitudinal bias layer could be readily perpendicular to that of the pinned magnetic layer even when the difference in the blocking temperature between the two antiferromagnetic films is only tens °C or so. Where the antiferromagnetic layer 152 is of a ordered antiferromagnetic film of PtMn or PdPtMn, it is desirable that the film could be ordered at resist-curing temperatures (200 to 250°C).

It is desirable that the spacing LD between the electrodes 16 is narrower than the spacing HMD between the longitudinal bias layers for lowering the reproduction device resistance and for realizing heads resistant to ESD. LD

generally defines the reproduction track, and it may be on a level of submicrons of from 0.1 to 0.7 μm for high-density recording (at least 10 Gbpsi) to which the invention is directed. On the other hand, HMD may be larger than LD by approximately from 0.3 to 1 μm so as to realize steep sensitivity profiles in the track width direction with few influences of the hard film magnetic field thereon even though the track width is narrow, thereby enabling high-sensitivity reproduction. In the condition of HD (device width) > LD and also HMD > HD, the spin valve device resistance between the electrodes can be reduced and, in addition, since the free layer in the spin valve film could have a rectangular profile of which the side in the track width direction is longer, the Barkhausen noise control is easy. Concretely, it is desirable that the device width HD is around 0.4 μm in view of the ESD resistance of the device. For the narrow track width for which the electrode spacing is at most 0.4 μm, it is desirable that the hard film spacing HMD is enlarged up to about 0.8 μm.

In the case of Fig. 50 where the distance between the center of the free layer in its thickness direction and the surface of the upper shield is represented by gf and the distance between that center and the surface of the lower shield is by gp, preferred is gf < gp for attenuating the current magnetic field Hcu to be applied to the free layer. This is because, since the free layer is nearer to the lower shield

than to the upper shield, it is more influenced by the magnetic field from the lower shield than from the upper shield, and, in addition, since the center through which sense current passes is shifted to the side of the nonmagnetic spacer 145, the free layer receives the magnetic field from the lower shield (this is generated by the lower shield as magnetized by sense current) in the direction opposite to the sense current magnetic field direction (see Fig. 50). With the sense current magnetic field being attenuated, a larger sense current may be applied to the device, whereby higher reproduction output and better BP are obtained, or that is, the asymmetry in the vertical direction of the reproduction wave form is reduced. Concretely, gp may fall between 35 and 80 nanometers and gf may fall between 25 and 50 nanometers with gf < gp. In that condition, the gap insulation could be kept, and the total reproduction gap length may fall between 60 ad 130 nanometers to realize an extremely narrow gap.

Fig. 52 is a conceptual view of one embodiment of a head which is suitable to the top-type spin valve film of Fig. 1 and Fig. 5. The case of Fig. 52 differs from that of Fig. 50 in that, in the former, the longitudinal bias layers 15 are formed on the lower gap film 12 after the spin valve film has been completely etched away. In the case of Fig. 52, it is desirable that the distance, gf, between the center of the free layer in its thickness and the surface of the lower shield is